Deloitte.

Global Model
Practice Survey 2014
Validation at Risk

Contents

Foreword

Dear Clients and Colleagues,

We are proud to present the results of the third edition of Deloitte's Global Model Practice Survey (GMPS). This survey was conducted between the second half of 2013 and the beginning of 2014 and focused on the state of the Model Validation function within financial institutions. We would like to take this opportunity to thank all survey respondents for their contribution to the GMPS and share our insights with you.

Models are at the heart of financial institutions. They are powerful tools in assessing risk and improving decision making. The outcomes of models are used by various stakeholders both throughout the organization as well as externally. However, if managed inappropriately, models can be a source of distress that, in some cases, can and have proven to be severe. This widespread use combined with increasing complexity of models gave rise to a new type of risk that financial institutions face: model risk. Model risk manifested itself several times during the financial crisis resulting for a number of financial institutions in significant model related losses.

Different regulatory regimes recognized the importance of model risk and imposed stricter requirements on model development, model validation, model use and model governance. On the other hand, we also observe that financial institutions become more aware of the potential magnitude of model related losses and are taking proactive steps to mitigate it. Accordingly, the role of the Model Validation function has become more and more prominent within financial institutions.

The survey results and attached checklist will provide you with key information on the state of Model Validation practice within financial institutions.

Yours sincerely,

Twan Kilkens
Managing Partner
Deloitte Financial Risk Management
The Netherlands

Executive summary

"The value and importance of model validation will further rise because of new regulatory requirements"

Group Manager of Model Validation of a bank

Increasing model complexity has given rise to a new type of risk faced by financial institutions: model risk. Both regulatory regimes and financial institutions have taken steps to address this type of risk. The cornerstone in managing model risk is an independent Model Validation function (hereafter: "Model Validation"). Model Validation provides an objective review to model development, hence addressing the issue of model risk. Furthermore, Model Validation plays an important role in assessing the compliance of models to internal and external regulations. As a result, Model Validation provides comfort to the stakeholders in the use of the models and thereby improves model-based decision making within an organization.

Currently, the practices of model validation activities vary among financial institutions. The GMPS 2014 analyzes these practices within various financial institutions across the globe. The respondents represent different geographies, industries, sizes and structures. Based on the completed set of responses we provide insight into the operation of Model Validation within various organizations. The key findings of the survey are listed below.

Model Validation has become an established practice

The added value of Model Validation for the business is being increasingly recognized, i.e. all survey respondents indicated that Model Validation adds value and the majority of the respondents acknowledge the technical expertise of Model Validation. Other functions, such as risk management and model development, also recognize the important role of Model Validation as mitigant of model risk. On the other hand, the most frequently cited reason for having a Model Validation function is still regulatory compliance.

The survey results demonstrate that model validation processes are becoming more mature and standardized. Compared to the GMPS 2011, significantly more respondents indicate that the ownership of the model inventory is formalized. This development improves the oversight of the model landscape within the financial institutions and herewith also the control framework.

Furthermore, compared to the GMPS 2011, the usage of external parties decreased. However, external parties still play an important role for Model Validation. The respondents cited various reasons to outsource, such as temporary insufficient resources and the independence of the external partiers. The respondents also indicated that fresh industry or financial modelling knowledge of the external parties is an important factor to outsource.

However, it is not a mature activity
Despite the achievements made over the last two years, there is still significant room for improvement. Many respondents indicate that Model Validation is still at its infant stage. Difficulties are experienced in adhering to the model validation cycle and the advice of Model Validation to reject or substantially remediate a model is often not followed. In addition, defining and documenting roles and responsibilities of Model Validation is considered to be challenging. In particular, for institutions with a decentralized Model Validation function or financial institutions without an independent Model Validation function, these roles and responsibilities are often not adequately documented.

The survey results indicate that in many cases Model Validation only covers regulatory models and that these models require more personnel to cover the desired scope. In addition, in order to be compliant with (future) regulations a substantial part of the respondents would like to broaden the scope of activities performed by Model Validation and increase the size of the team. Although respondents repeatedly state that Model Validation is "an under-staffed function" it is also frequently considered to be an "expensive function constrained by available resources". Partially due to these (temporary) insufficient resources about half of the respondents outsource model validation work to external parties.

Finally, the current state of performance assessment of the Model Validation function does not indicate a sufficient maturity of the function. In particular, a quarter of the respondents indicate to have no Key Performance Indicators for Model Validation.

Model Validation within banks is more mature than within other industries

Conforming to the results of GMPS 2009 and GMPS 2011, banks exhibit a higher maturity with respect to model validation practice than the other industries. One of the possible reasons is the banking capital regulation, which introduced requirement for model validation (Basel II). This regulation has come into force earlier than related capital regulation for the other industries. As a result, respondents indicate that Model Validation is used to assess compliance with external regulation more often by banks than by other industries. In addition, the proportion of the respondents from the banking industry indicating that they believe all models to be in scope of Model Validation is substantially higher than the proportion of respondents from the other industries. Not unsurprisingly, banks indicated on average twice as much justified grounds for model rejection compared to the other industries and perceived adherence to regulation as a justified ground twice as often as well. Furthermore, the survey indicates that banks have, compared to insurers, much better documented policies and procedures.

With respect to the organizational structure, Model Validation appears to be more mature at banks than at the other institutions. Almost all banks have a centralized Model Validation function within the domain of risk management. Other industries often have a decentralized Model Validation function where responsibilities are less clearly defined or do not have an independent Model Validation function at all. Banks also assign on average more FTE resources to Model Validation although the average model validation working experience is lower for banks. Larger departments (more common for banks) seem to have relatively fewer seniors and more juniors.

Going forward

We asked the respondents to provide their vision on the development of the Model Validation function in the next 3 years. The general consensus is similar to the survey of 2011: the respondents believe the importance and prominence of Model Validation to continue to increase in the future. Varying reasons for the increasing importance and prominence are provided. One is the continued increase in regulatory expectations for Model Validation. The regulation of financial institutions is expected to become even more stringent. Banks today still face challenges in implementing Basel II whereas Basel III is already imminent. The European insurers have to comply with Solvency II directive while upcoming and existing regulation for investment managers, pension funds and other financial institutions is increasing both in aggregate and with greater emphasis on quantitative requirements.

Finally, the survey results indicate that the main challenge faced by Model Validation is to move from a predominantly compliance function into a business partner which proactively manages model risk and ultimately promotes better usage of models within an organization.
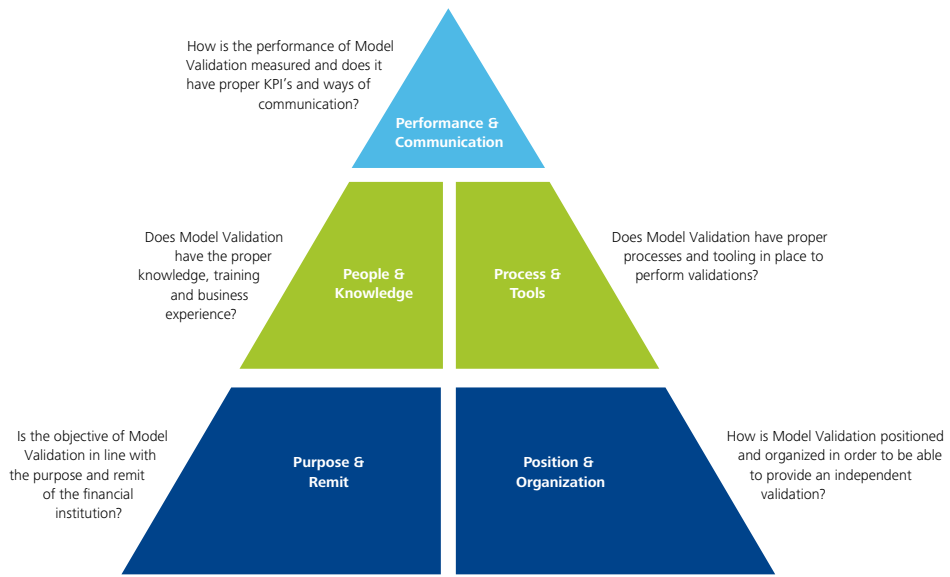
Introduction

Models are at the heart of financial institutions. They are powerful tools for decision support, scenario analysis and the valuation of assets and liabilities. Furthermore, models play an important role in identifying, measuring, monitoring and mitigating risks. Both internal and external stakeholders rely on information derived from models. As a result, inappropriate use of the models can have severe consequences. The financial crisis showed that the widespread use of models combined with the increasing complexity of models used gave rise to a new type of risk faced by financial institutions: model risk. Different regulatory regimes, such as CRD IV, UCITS, AIFMD, EMIR and Solvency II, recognized the importance of model risk and imposed stricter requirements on financial institutions to manage it. On the other hand, financial institutions become more aware of the potential magnitude of model related losses and are taking proactive steps to mitigate them.

Model Validation plays a key role in mitigating model related risks. The main task of Model Validation is to independently assess the quality of the models used by the organization. Certain elements of this task have already been performed by other functions, such as Internal Audit and Internal Control. However, due to the increasing complexity of models, this was not sufficient and it became clear that model design, methodology and model performance should also be independently assessed to determine the quality of a model. Moreover, such assessment can only be performed by professionals with specialized modelling skills. Therefore, a new function, Model Validation, was born.

Practices of Model Validation vary among organizations. Differences in practices are determined by a multitude of factors, among which are the industry, the maturity of the organization, the regulatory regime and the internal choices made when setting up the Model Validation function. In some cases, no separate function for model validation activities exists. There is no unique perfect design for the Model Validation function. Instead, Model Validation can be considered efficient as long as it delivers the final objective: provide an efficient independent challenge to the models used within the organization.

The survey of 2014 was conducted among 96 financial institutions worldwide between the second half of 2013 and the beginning of 2014. The purpose of the survey is to analyze the practices of Model Validation within financial institutions across the globe. The institutions that completed the survey represent different geographies, industries sizes and structures. Based on the completed set of responses we were able to provide a unique view on the setup and operation of Model Validation within various organizations. The results of this survey are presented in this report. We also compared the results of this survey with the results of the previous edition of this survey – GMPS 2011 – and observe the progress made by Model Validation over the past years.

Figure 1: Deloitte's 5P framework with corresponding questions

How is the performance of Model Validation measured and does it have proper KPI's and ways of communication?

Performance & Communication

Does Model Validation have the proper knowledge, training and business experience?

People & Knowledge

Does Model Validation have proper processes and tooling in place to perform validations?

Process & Tools

Is the objective of Model Validation in line with the purpose and remit of the financial institution?

Purpose & Remit

Position & Organization

How is Model Validation positioned and organized in order to be able to provide an independent validation?

The survey is structured according to Deloitte's 5P framework, which consists of five themes (i) Purpose & Remit, (ii) Position & Organization, (iii) People & Knowledge, (iv) Process & Tools, and (v) Performance & Communication. The 5P framework is an intuitive framework for analyzing the embedding of Model Validation in financial institutions. Figure 1 provides an overview of the 5P framework.

Figure 1 shows that the 5P framework is composed of three layers. The bottom layer is the organization of Model Validation. It defines the essential concepts of the function. Purpose & Remit and Position & Organization form this layer and analyze the objectives of Model Validation and the extent to which it is able to independently challenge a model. The middle layer is the apparatus, which supports the organizational setup. It is composed of People & Knowledge and Process & Tools, which analyze whether Model Validation has proper knowledge, training, business experience and whether it uses appropriate processes and tooling to perform adequate validations. Finally, the top layer concerns the output of Model Validation. This layer evaluates the Performance & Communication of Model Validation.

1. Respondents

The results of this survey are based on the responses from 96 financial institutions worldwide. This section provides a high level overview of the characteristics of the respondents.

Geography

The respondents are spread globally. Figure 2 visualizes the distribution of the participants per region.

About half of the respondents are employed at financial institutions operating on multiple continents. The majority of respondents (69%) are located at the head office of their financial institution. The proportions of the respondents located at regional level and business-line level are 12% and 19%, respectively.

The survey targeted practitioners within financial institutions from various departments along the model chain. The roles of respondents include model development, Model Validation, risk management, and internal audit (see Figure 3). In the survey we assessed to what extent answers are related to the role of the respondent in the organization. For example, we observed that respondents from Model Validation have a more optimistic view on the value added by Model Validation compared to respondents from other functions (see section 2. Purpose and Remit).

Industry

Figure 4 shows that most respondents work for either a bank (56%) or an insurance company (34%). Therefore, we analyzed the extent to which the answers differ between banks and insurers. The remaining 10% of the respondents are employed at asset managers, pension funds, hedge funds or security brokers. Because these industries account for only a small share, it is difficult to draw any specific conclusions for these industries based on the survey sample.
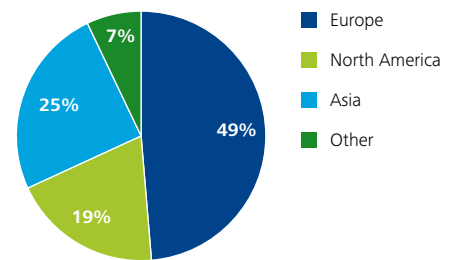
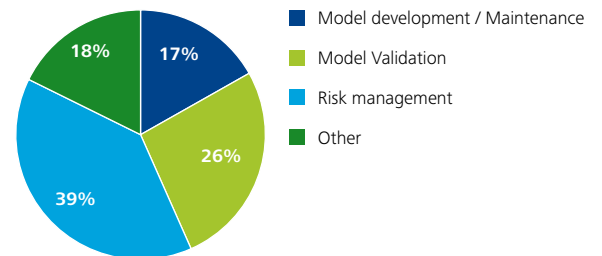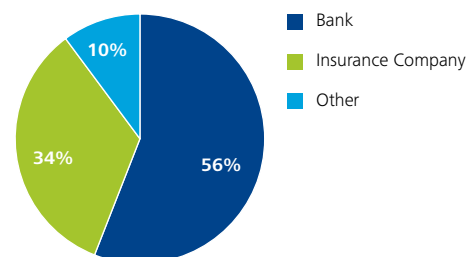**Figure 2: Geographical spread of respondents**

- Europe — 49%
- North America — 19%
- Asia — 25%
- Other — 7%

Figure 3: Role of respondents

- Model development / Maintenance — 17%
- Model Validation — 26%
- Risk management — 39%
- Other — 18%

Figure 4: Respondents by industry

- Bank — 56%
- Insurance Company — 34%
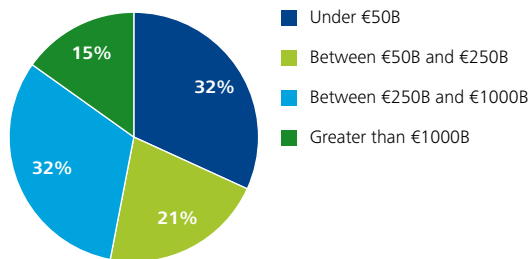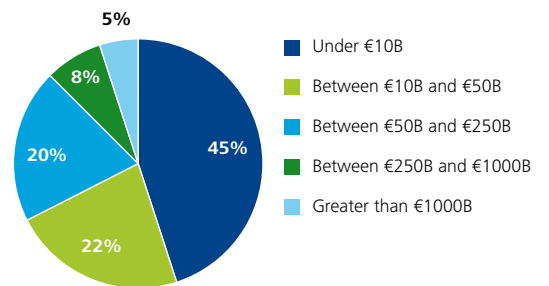- Other — 10%

When it comes to size, it is difficult to define a single metric that would be sensible for all industries in scope of this survey. Therefore, different indicators of size are used per industry. The size of insurance companies is measured by the amount of insurance reserves, see Figure 6. For banks and other financial institutions the size is measured by the total amount of assets, see Figure 5. In the survey we analyze to what extent answers differ with the size of the financial institutions. For example, we observed that small financial institutions struggle more with resources than large financial institutions.

Figure 5: Asset size of banking respondents

- Under €50B
- Between €50B and €250B
- Between €250B and €1000B
- Greater than €1000B

Figure 6: Amount of insurance reserves of insurance respondents

- Under €10B
- Between €10B and €50B
- Between €50B and €250B
- Between €250B and €1000B
- Greater than €1000B

2. Purpose and Remit

The added value of Model Validation is being increasingly recognized

The objectives and responsibilities of Model Validation are a foundation that determine all other aspects of model validation. Historically, the need to have a Model Validation function was imposed on financial institutions externally, that is, via capital regulation. Most advanced regulatory regimes require financial institutions to have an independent Model Validation function. However, the argument and logic behind this regulatory requirement is that an independent Model Validation function is essential in managing model risk, which proved to be a material risk due to an increasing complexity of models within financial institutions.

Within this survey we observe that the added value of Model Validation for the business is being increasingly recognized within financial institutions. Its important role as a mitigant of model risk is being accepted by risk management and model development. However, the most frequently cited reason for having a Model Validation function is still regulatory compliance. Consequently, the scope of Model Validation is to a large extent determined by a necessity to comply with regulation. However, a substantial proportion of the respondents would like to broaden the scope of Model Validation to include non-regulatory models as well.
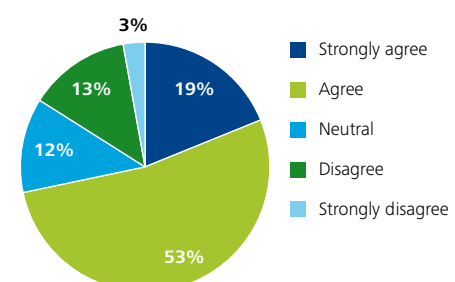
Scope of Model Validation
Two important determinants of the scope of Model Validation are the model landscape of the organization and regulatory requirements applicable upon the financial institution.

The model landscape of the organization determines to a large extent the number of models included in the scope of Model Validation. Survey results indicate that banks have on average more models in scope of Model Validation than insurers. Furthermore, banks undertake a more diverse range of activities, which requires them to utilize more models. In particular, the mitigation of credit risk – a risk that is more prevalent in banking – requires relatively more models than underwriting risk, which is more common in insurance.

Regulatory requirements, on the other hand, determine to a large extent the number of models that must be included in model validation. In some cases, particularly in the US, an institution is required by the regulation to validate all models used. In other cases, particularly Basel II/III and Solvency II, only internal risk models are subject to the validation requirement. In less stringent regimes, there might be no requirement and the validation is driven by internal desire to address model risk.

Figure 8 shows that approximately half the respondents validate all models. Furthermore, 22% only validate material models and 20% only validate models with regulatory oversight. This implies that only two thirds of the respondents validate models subject to regulatory oversight. This closely relates to the observation that around two thirds of the respondents indicate Model Validation should include all models in scope, see Figure 7. Hence, a significant portion of the respondents are not satisfied with the current scope of Model Validation and indicate that more models should be included. Compared to banks, insurers lag behind with respect to the scope of Model Validation. The majority of respondents from the banking industry indicate that the scope of Model Validation includes all models, whereas the most frequently provided response within the insurance industry is that Model Validation validates only material models. As stated earlier, this difference in maturity is likely due to the fact that bank regulation, e.g. Basel II (2008), was enforced earlier than insurance regulation, Solvency II (anticipated as of early 2016).
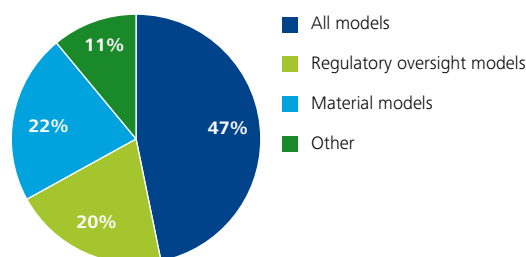
Figure 7: Model Validation includes all models that should be in scope

- Strongly agree — 19%
- Agree — 53%
- Neutral — 12%
- Disagree — 13%
- Strongly disagree — 3%

Figure 9: Top three drivers for having Model Validation'

Legend: ■ Most important driver ■ 2nd most important driver ■ 3rd most important driver

Figure 8: Model Validation validates the following models

- All models — 47%
- Regulatory oversight models — 20%
- Material models — 22%
- Other — 11%

Value of Model Validation

The added value of Model Validation is being increasingly recognized by financial institutions. However, as shown in Figure 9, regulatory compliance is still considered to be the most important driver for having Model Validation.

Besides regulatory compliance, mitigating model risk is also frequently mentioned as an important driver for having Model Validation. Respondents state that this feature has the greatest added value for the business, see Figure 10. More interestingly, none of the respondents believe Model Validation has no added value for the business. Furthermore, Figure 10 illustrates a bias in the perception of Model Validation concerning the value added by Model Validation for the business. Respondents from Model Validation consider the value added by Model Validation for the business consistently higher than the added value perceived by respondents fulfilling other roles. In particular, the advisory role of Model Validation is valued much higher by respondents from Model Validation than by respondents fulfilling the other roles. This suggests a misalignment in the perception of Model Validation versus its stakeholders with respect to the role of Model Validation.

Figure 10: Added value of Model Validation for the business

Legend: ■ Model Validation ■ Other roles
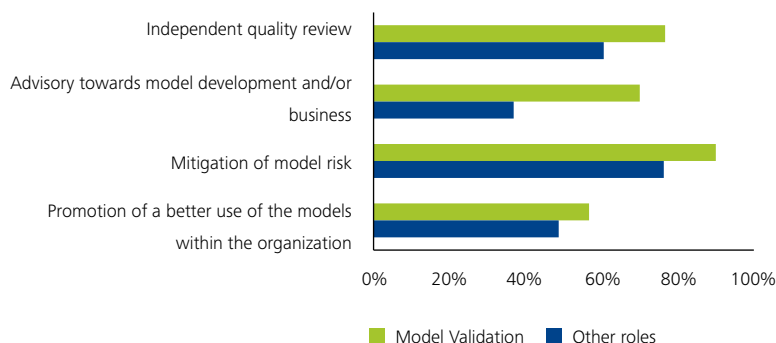
3. Position and Organization

"Established as added-value to model developers by independent second oversight"

Director risk management at a German bank

The second cornerstone of a solid Model Validation function is its position within the organization and governance surrounding its activities. The organizational design of Model Validation should facilitate the fulfilment of its objectives. It is crucially important for Model Validation to be independent function. Without independence, its objective of being the challenger of model development can be at risk. The activities of Model Validation should be embedded in the overall model governance of the organization. Clear processes, procedures, committee structures and escalation lines should be defined and documented. On the other hand, effective cooperation and collaboration is essential for the success of Model Validation.

We observe a variety of organizational designs of Model Validation. There is no unique perfect design for the Model Validation function. Model Validation can be considered efficient as long as it delivers the final goal: to provide an efficient independent challenge to the models used within the organization.

The results of the survey show that, despite the achievements made over the last two years, there is still significant room for improvement. Difficulties are experienced in adhering to the model validation cycle and the advice of Model Validation to reject or substantially remediate a model is often not followed. We also observe a difference in maturity between the industries. Banks exhibit a higher maturity than other industries, particular in how Model Validation is organized, which bodies take responsibility for Model Validation, and how model rejection takes place.

Organization and Responsibilities of Model Validation

Model Validation departments tend to be organized centrally. Respectively 82% and 67% of the respondents within banks and insurers indicate having centralized Model Validation. However, the allocation of the responsibility for Model Validation differs between significantly bank and insurers. 90% of the respondents within the banking industry indicate that model validations are performed within the functional area of risk management. Within the insurance industry, this is 60%. In other cases, responsibility for model validations resides within the functional areas of internal audit or finance.

53% of the respondents employed at insurance companies (strongly) agree that roles and responsibilities within the model life cycle are adequately defined and documented compared to 78% of the respondents employed at banks. For insurers having a decentralized Model Validation function this figure is only 33%. Furthermore, 42% of insurers with a decentralized model validation department (strongly) disagree that these roles and responsibilities are adequately defined and documented, versus 9% of those with a centrally organized model validation function. These results underline that roles and responsibilities are more difficult to define and document in decentralized Model Validation departments than at centralized Model Validation departments.

Figure 11 displays the difference in responsibility for Model Validation between banks and insurers. It shows that business owners/users of models at insurance companies more often than at banks provide final model approval (32% versus 4%). For insurers with a decentralized Model Validation function this is 67%. This reflects the absence of formalized structures and procedures for model approval. This resonates with the earlier observation that within decentralized Model Validation organizations roles and responsibilities tend not to be adequately documented.

Figure 11: Who or what body/bodies provide(s) final approval of the use of models
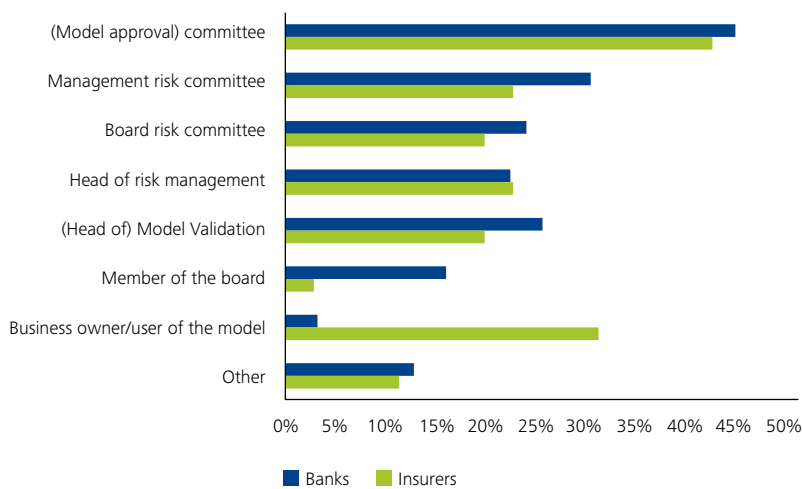
The majority of respondents (70%) (strongly) agree that issues raised in the model validation process are addressed and resolved timely and appropriately. About 30% of the respondents experience issues with addressing Model Validation findings. These figures are stable across industries and sizes.

There is little difference between the ownership of the model inventory between banks and insurers. Remarkably, model development hold the model inventory in 21% of the cases (30% banks, 9% insurance companies) and 20% of the respondents indicate that ownership of the model inventory is not formalized. These numbers are not related to the size of the financial institution, e.g. even large financial institutions often do not have a formalized model inventory.

Compared to the GMPS of 2011, an improvement of the maturity of the ownership of model inventory can be seen. In 2011 approximately 30% of the respondents indicated the model inventory was not formalized. In 2014 this number reduced to 20%. Hence, oversight of the status of models within the financial institutions have improved and herewith the control over the models in use as well.

**Adherence to Model Validation Cycle and Process**
Several questions in the survey examined adherence to the Model Validation timelines and scope as well as rejections of models. The survey results show that most of the respondents follow their own procedures. However, a number of respondents still experience difficulties.

Eight out of ten respondents indicate that no more than 25% of models in scope of Model Validation are either delayed for more than 3 months or do not go through the validation process at all. In addition, 21% of the respondents experience material difficulties in adhering to the model validation timelines. Furthermore, 18% of the respondents indicate that during the past two years there were models approved by the model approval body, which not following the advice of Model Validation to reject or substantially remediate the model. These figures are stable across industries.

The GMPS 2011 also showed that it was challenging to reject models. 14% of the respondents of the GMPS 2011 indicated that Model Validation actually never rejected a model. One of the possible reasons being that Model Validation had insufficient specialized knowledge on the models as compared to model development. Furthermore, GMPS 2009 indicated that the independence between model development and Model Validation was generally not ensured. This could be due to the fact that model development and Model Validation have similar interests with respect to regulatory compliance. Hence, they might coordinate model development in an earlier phase of the process.

In the GMPS 2014 approximately 40% of the respondents indicate that none of the model validation reports produced advised substantial remediation or rejection to the model approval body. For banks this is 27% and insurers 58%, see Figure 12.

Figure 12: During the last two years, on average, how many model validation reports advised substantial remediation or rejection to the model approval body (as a percentage of all models validated)?
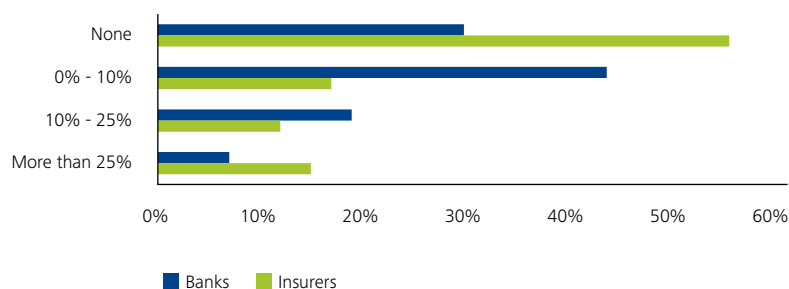
Banks   Insurers

The survey results do not reveal a relation between the advice for substantial remediation or rejection of a model and the functional area performing the model validation. The difference between banks and insurers might be explained by their perspective on what could be considered a justified ground for model rejection. Respondents from banks indicate on average six types of justified grounds, whereas respondents from insurance companies indicate on average three types (see Figure 13). Furthermore, all respondents indicate that model performance, the methodology and the assumptions are the three foremost justified grounds for model rejection. This is in line with the results from the GMPS 2011.

Figure 13 also shows that respectively 53% and 22% of the banks and insurers indicate that adherence to regulation is considered a justified ground for model rejection. This is surprising because the respondents indicate that adherence to regulation is the most important driver for having Model Validation (see Figure 9). From the initial phase until implementation, model development needs to remain aware that use of the models output is not allowed by the supervisor if the model itself does not comply with regulations. In an ideal situation, models not complying with regulations should never be used by the organization. For models subject to regulatory oversight, verifying regulatory compliance should therefore be an integral part of every validation. This prevents rejection of the model by the regulator.

Figure 13: Which, if any, are considered justifications for Model Validation rejecting the use of a model?
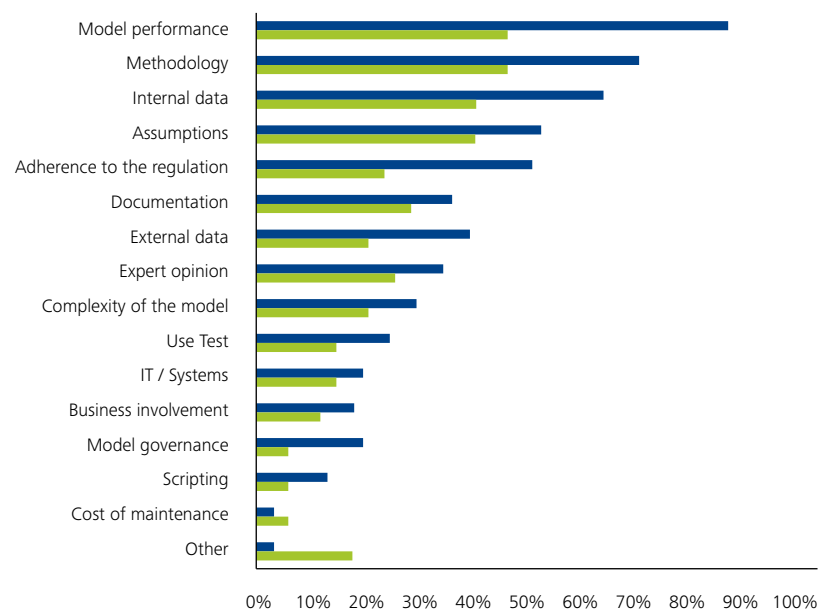
4. People and Knowledge

"Models are reviewed by expert people, who are not involved in their construction"

Manager risk management at a Latin American bank

At the core of well-functioning Model Validation function are the people and their expertise. Having a sufficient number of people with appropriate modelling experience and knowledge is vital for providing an objective challenge to model development. A wide variety in responses can be observed concerning staffing, expertise and effort spent per model. Some respondents believe their Model Validation is already well-established and perceive it as a "thorough, knowledgeable, and reasonable party", whereas other respondents indicate that Model Validation "needs more resources and validation training" in order to "do a better job". Not unsurprisingly, training, knowledge and business experience is an important focus area. However, the survey results also indicate that a significant portion of the respondents consider attracting and retaining talent challenging.

The results of the survey concerning people and knowledge exhibit a clear distinction between banks and the other industries. Banks have larger Model Validation departments requiring on average more time to perform a validation, indicating a wider scope. These are indications that banks are ahead of the other industries with regard to their Model Validation resources. On the other hand, employees of Model Validation within banks have on average shorter model validation and industry experience. This can be explained by the fact that larger departments (more common for banks) seem to employ relatively fewer seniors and more juniors.

Furthermore, Model Validation requires a substantial amount of expertise to be able to provide sufficient countervailing power to model development. Knowledge and skills of the model validators are considered vital components of Model Validation in order to challenge the expertise of model development and be "a valuable contribution to model development processes". Therefore, it is key for Model Validation to have sufficient resources for personnel and training.

Size and resources

Consistently with the results of the GMPS 2011, the GMPS 2014 shows that Model Validation departments within banks employ on average more FTE's than within insurers, see Figure 14. Almost all respondents who indicated the size of their Model Validation departments to be more than 10 FTE are employed at banks. Furthermore, around 20% of the insurers indicate to have no independent Model Validation department at all. Although this is still substantial, it is a considerable improvement compared to the findings of the GMPS 2011 which displayed that the majority of insurers (65%) had no independent Model Validation. Regarding scope, we see two thirds of the respondents with large Model Validation departments (more than 10 FTE) validating "all models" compared to 40% of the respondents within smaller Model Validation departments (less than 10 FTE). Finally, the difference in size of Model Validation departments between banks and insurers could be explained by the fact that banks simply validate more models on average.

Figure 14: How many FTE's does Model Validation?
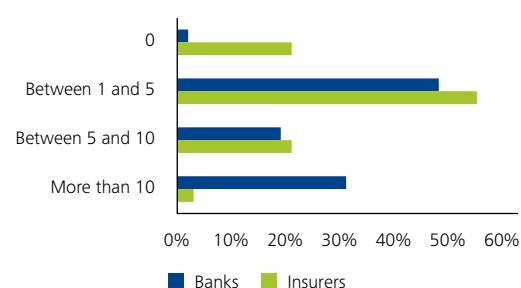
"Ideally, we would like to expand, but expansion is currently constrained by available resources"

Vice-President risk management at a Bermudan insurer

As described previously, some financial institutions consider Model Validation to be at its infant stage. The development of the function can also be constrained by the availability of resources. We observe that the majority of respondents (about 57%) indicate that more resources are needed to meet the desired scope (see Figure 16), whereas only 46% of the respondents indicated growth plans for Model Validation (see Figure 15). The respondents confirmed this observation by describing Model Validation as "an under-staffed function" that "requires additional personnel", as well as an "expensive function", which is "constrained by available resources".

Figure 15: Plans of percentage growth of Model Validation in FTE

- No plans to grow
- Yes, by 10%
- Yes, by 25%
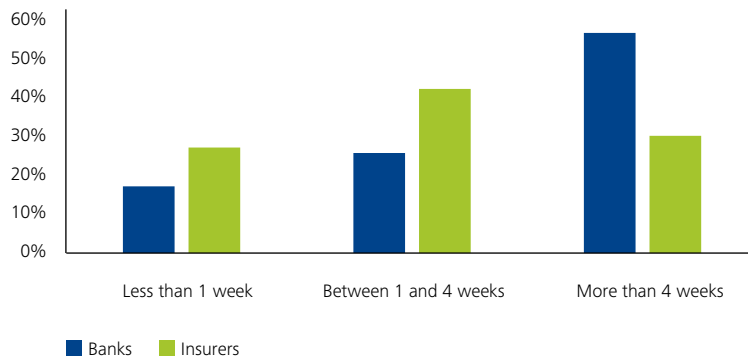- Yes, by 50% or more
- Don't know

41%
13%
18%
15%
13%
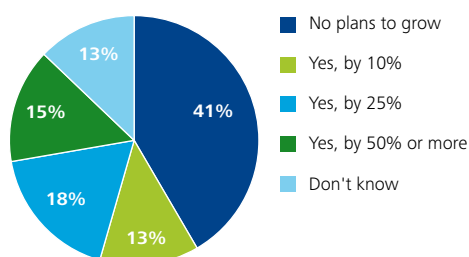
Throughput time and outsourcing

The GMPS 2011 revealed that the majority of insurers completed a validation within one to four weeks, with banks requiring on average more time. In this year's GMPS we see similar results, see Figure 17. Considering the median of FTE days required to perform a model validation, we observe that insurers require 4 weeks, whereas banks require 6 weeks. The difference between banks and insurers can arise for various reasons; differences in model complexity, differences in model validation maturity or differences in the model validation scope.

Figure 16: Percentage of resources needed for desired scope of Model Validation

- Less than 90%
- Between 90% and 110%
- Between 110% and 125%
- More than 125%
- Don't know

6%
23%
16%
41%
14%
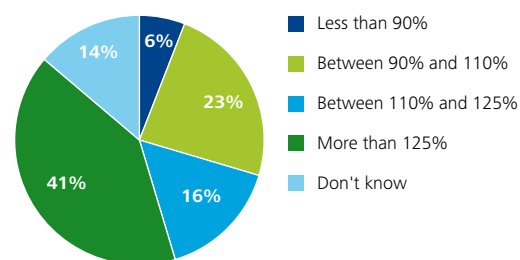
Figure 17: Average total effort in FTE days needed to perform a model validation


In addition, the difference between banks and insurers is also noticeable in the throughput time between the start of a validation and the submission of the resulting model validation report to the model approval body. The median observed average elapsed time is two months for banks and one month for insurers. Hence, the entire validation process lasts on average longer at banks than at insurers. This can (partly) be explained by the difference in maturity. Banks, being more mature, have a broader scope and at the same time focus more on detail. Furthermore, banks seem to have better documentation, which could also contribute significantly to the difference in the time observed.

Figure 18: What is an average elapsed time between the start of the model validation and the submission of the model validation report to the model approval body (in weeks)?
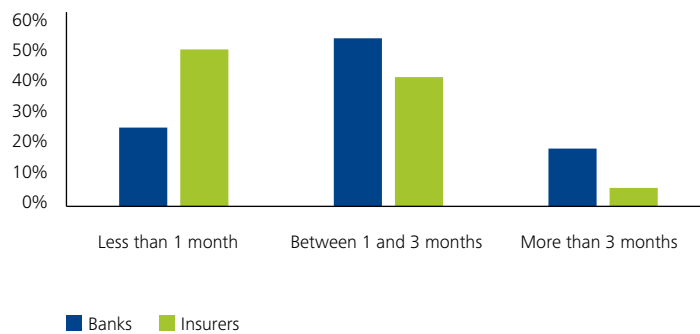
Approximately half of the financial institutions outsource model validation work showing that external parties play an important role for Model Validation. The other half of the respondents indicate no model validation work is outsourced at all, see Figure 19. In particular, banks with large Model Validation functions make limited use of external parties. Figure 20 summarizes the objectives for the outsourcing.

Figure 19: Percentage of model validation work outsourced

- 0%
- Between 0% and 10%
- Between 10% and 25%
- More than 25%

15%
16%
52%
17%
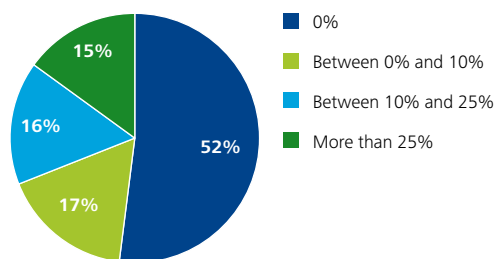
The majority of respondents outsourcing model validation activities indicate temporary insufficient resources and fresh industry or financial modelling knowledge to be the foremost drivers for outsourcing model validation work. The latter is the most frequent response given by representatives of small institutions, whereas large institutions more often indicate challenges to recruit adequate resources as the reason to outsource. This is in line with expectations, as small institutions are less likely to employ a team with sufficient modelling knowledge due to scale constraints and challenges to retain a critical mass of Model Validation employees. Furthermore, we believe that temporary insufficient resources are an important driver for outsourcing because of the fluctuating workload of Model Validation activities, which is affected by seasonal effects and regulatory development.

Compared to the results of the GMPS 2011, the usage of external parties decreased. In 2011, 40% of the respondents indicated that no Model Validation work was outsourced, compared to 52% in 2014's survey. Many respondents (70%) from 2011's survey indicated independence to be an important driver for outsourcing. A respondent from a Dutch insurer stated similarly to the survey in 2014 that "challenging our own model validation work" was an important driver for outsourcing model validation work. Furthermore, outsourcing could remedy earlier observed issues, internal political pressures on Model Validation departments, the frequency of model rejections or supposed dependence issues between Model Validation and model development.

Outsourced validation are often performed by parties with high expertise in model validation work. One of the respondents from a UK bank also states that "the outsourced validation team is well regarded by the regulator".

Figure 20: Drivers to outsource model validation work
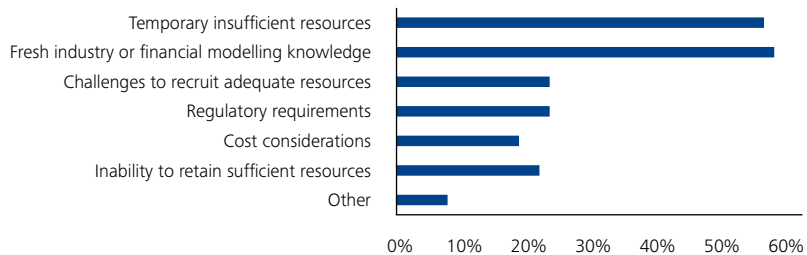
Knowledge

Employees in Model Validation have on average 7.6 years working experience in the industry and 4.5 years work experience in model validation work. We observe that the latter is lower for banks. Banks have larger Model Validation departments and these larger departments tend to have fewer seniors and relatively more juniors. Another reason is that model validation employees tend to switch jobs more often in the banking sector. Next to this, we see that contrary to the overall trend, insurers tend have more departments with limited working experience (less than two years). We think these companies just started up Model Validation, which also could explain the relatively high percentage of relatively inexperienced departments.

Although around 70% of the survey respondents state that Model Validation has no formalized training curriculum, the survey respondents are very satisfied with the available knowledge and expertise of Model Validation in general. Around 88% of the survey respondents find that Model Validation has sufficient technical knowledge.
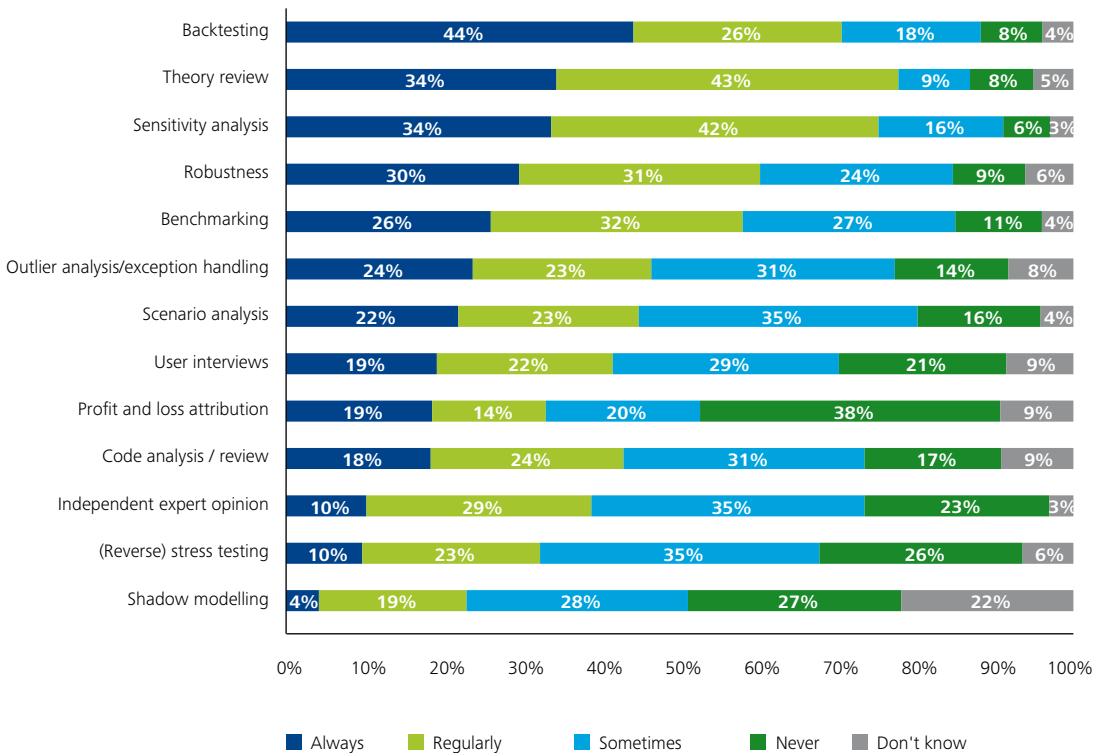
5. Process and Tools

The validation activities have to be supported with proper tooling and consistent methods. Adequate and prescribed processes and tools facilitate effective execution of a model validation. A standardized set of validation tools and processes considerably simplifies the effort needed to perform a model validation and allows the validators to focus on the content aspects of the validation. Furthermore, without the appropriate tools and processes, an organization would struggle to achieve its validation goals.

Validation tools

Figure 21 shows the extent to which several tools are used by Model Validation. Back testing, sensitivity analysis and theory reviews are the most commonly used tools. Less frequent (although still widely cited) were benchmarking and robustness tests. Compared to the results of the GMPS 2011, we observe that theory review has become a less popular validation tool. In 2011, around 78% of the respondents indicated using theory review as validation tool. In 2014, this number dropped to 33%. Benchmarking and stress testing, on the other hand, have become more popular.

Figure 21: Average percentages of validation tools used by the aggregate financial industry

	Always	Regularly	Sometimes	Never	Don't know
Backtesting	44%	26%	18%	8%	4%
Theory review	34%	43%	9%	8%	5%
Sensitivity analysis	34%	42%	16%	6%	3%
Robustness	30%	31%	24%	9%	6%
Benchmarking	26%	32%	27%	11%	4%
Outlier analysis/exception handling	24%	23%	31%	14%	8%
Scenario analysis	22%	23%	35%	16%	4%
User interviews	19%	22%	29%	21%	9%
Profit and loss attribution	19%	14%	20%	38%	9%
Code analysis / review	18%	24%	31%	17%	9%
Independent expert opinion	10%	29%	35%	23%	3%
(Reverse) stress testing	10%	23%	35%	26%	6%
Shadow modelling	4%	19%	28%	27%	22%

> "Model validation is a necessary and efficient assessment tool to prove the adequacy and soundness of the internal models, especially with regards to external regulations and internal audit"

Group Manager of Model Validation at a German bank

The survey results indicate that respondents from banks tend to select more validation tools per response, as well as more likely choose 'Always' and 'Regularly' as responses, than the respondents within the insurance industry. Especially for back testing and theory review, the difference is prominent. For example, 56% of the respondents from banks selected 'Always' for back testing and 40% selected 'Always' for theory review compared to respectively 28% and 19% for respondents from the insurance industry. Profit and loss attribution is the only validation tool that has a reversed pattern: 38% of the respondents from the insurance industry report they always use this tool, compared to 4% for banks only. We believe a wider range of validation tools used by an institution signals a higher maturity of Model Validation.

Both banks and insurance companies primarily use Excel as software tool for Model Validation. They differ with respect to second most used software tool, which is statistical software for banks and actuarial software for insurance companies. However, we observe the usage of standardized library of scripts not to be widespread. 52% of respondents indicated that Model Validation does not use such a library (36% banks, 75% insurers).

Assessment Model Validation

In the GMPS 2011 we observed that methodology, model performance, assumptions, documentation and compliance with regulatory requirements were the five primary areas of which Model Validation assessed the soundness. The results of the GMPS 2014 are similar with respect to the areas in scope of Model Validation. The only difference being compliance with regulatory requirements. In 2011, 88% of the respondents indicated that soundness of models with respect to regulatory requirements was assessed by Model Validation. In 2014, this number decreased to 67%. This can be explained by the difference between banks and insurers. Whereas banks indicate this area in 81% of the cases, insurers only point this out in 42% of the cases.

The objective of Model Validation is to mitigate model risk. The risk arising from using models is linked to the size and the risks of the portfolio for the organization. Therefore, it is not sufficient to look at models in isolation. It is necessary to take the business environment and the materiality of the model into account.

Three quarters of the respondents feel that the business is adequately consulted in Model Validation activities. 69% of the respondents (strongly) agree that the model, risk and portfolio characteristics are taken into account in the allocation of resources for a model validation. 82% of the respondents within banks (strongly) agree with this statement whereas for respondents from insurance industry this is 47% only. There is also a clear dependency on size. Respondents from large institutions tend to agree with this statement more frequently than respondents from small institutions. An interesting observation is that respondents from large insurers are much more affirmative than respondents in large banks.

When deciding on the allocation of FTE days to validate a model, the three most prominent factors were complexity of the model/amount of model risk, risk of the underlying portfolios and exposure of the underlying portfolios.

Documentation

Documentation forms a key part of any process as it facilitates a clearly defined and transferrable process. The general perception is that documentation is one of the neglected areas. The findings below illustrate this observation.

70% of the participants have documentation templates, while only 35% have a regulatory checklist or working paper templates. This finding shows that organizations often do not even have documentation templates, let alone other elements of documentation. The fact that the regulatory checklist was one of the least frequent responses is even more surprising given that regulatory compliance showed to be one of the most important drivers of having a Model Validation function.

As expected, the most frequent response is validation process (80%). Approximately 10% of the respondents indicate that no clearly defined policies and procedures are available for the items listed in Figure 22. Of those respondents, 90% are employed at insurance companies.

Figure 23 highlights the main areas of the internal quality review of model validation reports. The most frequent response is substantiation of findings (62%) closely followed by executive summary (58%).

To conclude, with respect to documentation and internal quality review, there is still significant room for improvement for Model Validation.

Figure 22: Items for which Model Validaton has a clearly defined set of policies and procedures
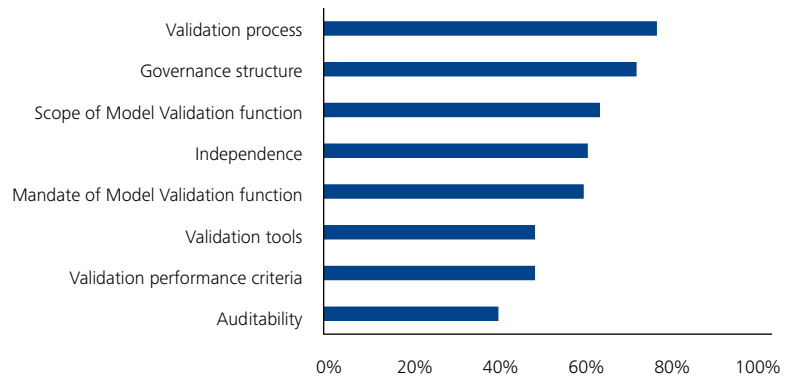
Figure 23: Model Validation performs an internal quality review on the validation reports on the following elements'

■ Banks ■ Insurers
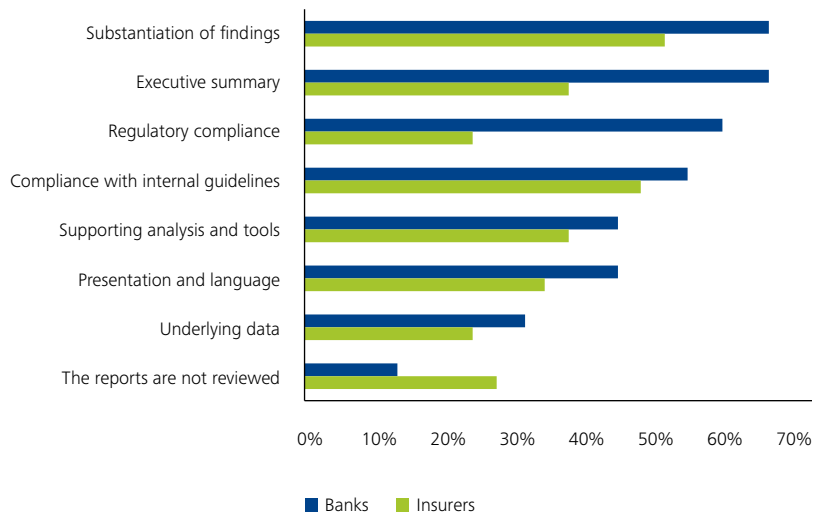
6. Performance and Communication

Clear performance measurement and communication of the results and achievements of Model Validation is key for the successful contribution of Model Validation to the business. However, a thorough assessment of the performance of Model Validation without jeopardizing its independence, is considered a major challenge in the evaluation of Model Validation. To achieve this, a set of clear and proper Key Performance Indicators ("KPI's") should be defined, reflecting performance adequately without conflicting with the required independence. Many respondents face challenges relating to this: a quarter of the respondents have no KPI's at all.

At the same time, without smooth communication between Model Validation and other functions, the added value of other elements of a successful model validation can be curtailed. We observe that Model Validation has clearly established communication channels, such as validation reports, which are distributed towards all relevant stakeholders. However, some aspects of efficient communication with the stakeholders, especially when it comes to bad news, are still considered challenging.

Performance

Validation activities should be performed by parties independent from the models' design, development and use. This can be done internally as well as an externally. The same reasoning also holds for the performance assessment of Model Validation. The survey results show that around 60% of the respondents indicate that the performance of Model Validation is assessed by an external party. Figure 24 shows that internal audit and the regulator are the internal and external parties most often assessing the performance of Model Validation. Usually, it suffices to assess the functionality of scope and procedures internally when the model has limited significance for the business.

Figure 24: Departments responsible for assessment performance Model Validation
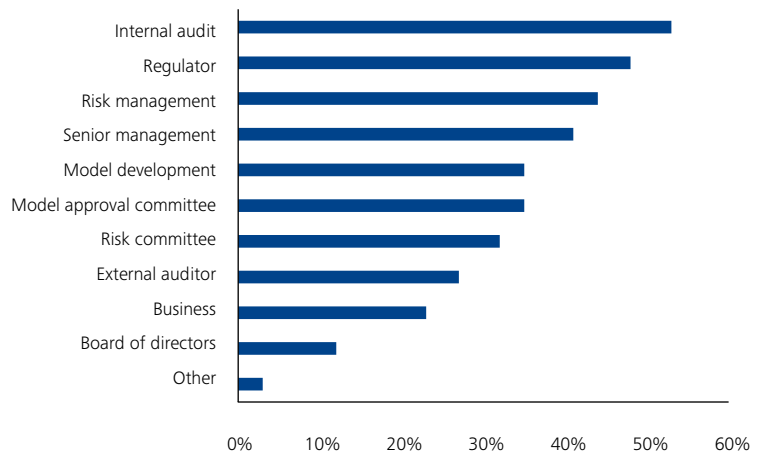
35% of the respondents indicate that model development plays a role in assessing the performance of Model Validation. However, this potentially creates a dependence problem between Model Validation and model development and therefore model development cannot be solely responsible for the evaluation of Model Validation performance. This can also be observed in the survey results, as in 95% of these cases, other departments are involved in the performance evaluation as well. Overall, on average four functions are involved in the performance assessment of Model Validation. This mitigates the risk of biased judgments.

Although the performance assessment of Model Validation is divided over several functions, it does not appear to be sufficiently matured yet. Respondents face difficulties in defining proper KPI's. A quarter of the respondents indicate to have no KPI for Model Validation at all, see Figure 25.

Figure 25: Number of KPI's for Model Validation
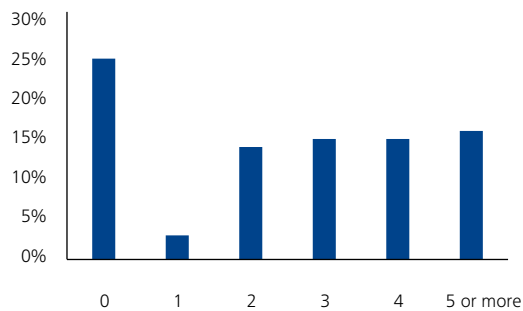
Meeting validation deadlines is currently considered the most important KPI for Model Validation. We believe that this could be a threat for the independent role of Model Validation.

Communication

In order to communicate outcomes to relevant stakeholders in a clear and concise way, it is important to align the processes and policies of Model Validation with all relevant stakeholders. Survey results show that targets, priorities and timelines are most often communicated with senior management (53% of the cases). The risk committee and model development (31% and 32% respectively) are often consulted for defining specific processes and targets as well.

The model validation reports are distributed towards three stakeholders on average. The reports are most often communicated towards model development (77%) and senior management (61%). We expect that regulators become more important as stakeholder in the Model Validation function as more external regulation and requirements are being developed to assess the soundness of risk models used by financial institutions.

7. Conclusion

In recent years, the prominence of model risk increased substantially. Both regulatory regimes and financial institutions have taken steps to address this type of risk. The cornerstone in managing model risk is an independent Model Validation function. Model Validation provides an objective review to model development, hence addressing the issue of model risk. In addition, Model Validation plays an important role in assessing the compliance of models to internal and external regulation. As a result, Model Validation provides comfort to the stakeholders in the use of the models and thereby improves model-based decision making within an organization.

In this survey, we observe how the practices of Model Validation have developed over the last few years and how activities currently vary among financial institutions across the globe. The respondents represent different geographies, industries, sizes and structures. Based on the completed set of responses we provide insight into the operation of Model Validation within various organizations. The key findings of the survey are listed below.

Model Validation has become an established practice

The important role of Model Validation as mitigant of model risk is being increasingly recognized. All survey respondents indicated that Model Validation adds value and the majority of the respondents acknowledge the technical expertise of Model Validation. On the other hand, the most frequently cited reason for having a Model Validation function is still regulatory compliance.

The survey results demonstrate that model validation processes are becoming more mature and standardized. Compared to the GMPS 2011, significantly more respondents indicate that the ownership of the model inventory is formalized. This development improves the oversight of the model landscape within the financial institutions and herewith also the model control framework.

Furthermore, compared to the GMPS 2011, the usage of external parties decreased. However, external parties still play an important role for Model Validation. The respondents cited various reasons to outsource, such as temporary insufficient resources and the independence of the external partiers. The respondents also indicated that fresh industry or financial modelling knowledge of the external parties is an important factor to outsource.

However, it is not a mature activity

Despite the achievements made over the last two years, there is still significant room for improvement. Many respondents indicate that Model Validation is still at its infant stage of maturity. Difficulties are experienced in adhering to the model validation cycle and the advice of Model Validation to reject or substantially remediate a model is often not followed. In addition, defining and documenting roles and responsibilities of Model Validation is considered to be challenging, in particular, for institutions with a decentralized Model Validation function or financial institutions without an independent Model Validation function.

The survey results indicate that in many cases Model Validation only covers regulatory models and that these models require more personnel to meet the desired scope. In addition, in order to be compliant with (future) capital regulations a substantial part of the respondents would like to broaden the scope of activities performed by Model Validation and increase the size of the team. Although respondents repeatedly state that Model Validation is "an under-staffed function" it is also frequently considered to be an "expensive function constrained by available resources". Partially due to these (temporary) insufficient resources about half of the respondents outsource model validation work to external parties.

Finally, the current state of performance assessment of the Model Validation function does not indicate a sufficient maturity of the function. In particular, a quarter of the respondents indicate to have no Key Performance Indicators for Model Validation.

Model Validation within banks is more mature than within other industries

Conforming to the results of GMPS 2009 and GMPS 2011, banks exhibit a higher maturity with respect to model validation practice than the other industries. One of the possible reasons is the banking capital regulation, which introduced requirement for model validation (Basel II). This regulation has come into force earlier than related capital regulation for the other industries. As a result, respondents indicate that Model Validation is used to assess compliance with external regulation more often by banks than by other industries. In addition, the proportion of respondents from the banking industry indicating they believe all models to be in scope of Model Validation is substantially higher than the proportion of respondents from other industries. Not unsurprisingly, banks indicated on average twice as much justified grounds for model rejection compared to the other industries and perceived adherence to regulation as a justified ground twice as often as well. Furthermore, the survey indicates that banks have, compared to insurers, much better documented policies and procedures.

With respect to the organizational structure, Model Validation appears to be more mature at banks than at the other institutions. Almost all banks have a centralized Model Validation function within the domain of risk management. Other industries often have a decentralized Model Validation function where responsibilities are less clearly defined or do not have an independent Model Validation function at all. Banks also assign on average more FTE resources to Model Validation although the average model validation working experience is lower for banks. Larger departments (more common for banks) seem to have relatively fewer seniors and more juniors.

Going forward

We asked the respondents to provide their vision on the development of the Model Validation function in the next 3 years. The general consensus is similar to the survey of 2011: the respondents believe the importance and prominence of Model Validation to continue to increase in the future. Varying reasons for the increasing importance and prominence are provided. One is the continued increase in regulatory expectations for Model Validation. The regulation of financial institutions is expected to become even more stringent. Banks today still face challenges in implementing Basel II whereas Basel III is already imminent. The European insurers have to comply with Solvency II directive while upcoming and existing regulation for investment managers, pension funds and other financial institutions is increasing both in aggregate and with greater emphasis on quantitative requirements.

Finally, the survey results indicate that the main challenge faced by Model Validation is to move from a predominantly compliance function into a business partner which proactively manages model risk and ultimately promotes better usage of models within an organization.

Appendix – Research Methodology

Deloitte's 2014 Global Model Practice Survey (GMPS) obtained the data through an online questionnaire from 96 respondents working at large financial institutions around the globe. The survey consisted over 50 questions and analyzes the current practices of financial institutions in the context of their model risk functions. The questionnaire investigates how Model Validation is embedded within model management practices. With the help of Deloitte's global network we carefully selected participants who are practitioners within financial institutions from various departments along the model chain: model development, Model Validation, risk management, model approval committees and internal audit. Respondent's data is anonymized.

The questions are structured around the five themes of Deloitte's 5P framework. The survey questions vary in type – open, single answer multiple choice, multiple answer multiple choice – and the degree of profundity. Apart from questions relating to these five themes, we included questions relating to firm- and occupational characteristics. This extensive range of questioning provides valuable insights in the results "beyond the answers". By cross-referencing data we compared results between industries, functions and regions, to name a few. Furthermore, comprehensive (statistical) analysis and thorough team discussions have led to both confirmation and rejection of presumptions.

Appendix – Key Criteria of Sound Model Validation Practice

The survey results illustrate that, despite a considerable progress, the respondents still face some difficulties when implementing effective model validation practice. Based on this generic observation, our model validation team designed a comprehensive set of criteria which we think are important for a sound Model Validation practice. Furthermore, we incorporated various views on Model Validation from different industries and geographies. For your convenience, we have converted these criteria into a leading practice checklist, which may serve you in enhancing your model validation practice. The checklist consists of three sections: Model Validation Governance, Business Focus, and Scope of Model Validation.

Model Validation Governance

- Does Model Validation have a clearly defined mandate?
- Does Model Validation have clearly documented model validation policies and procedures?
- Is the place of Model Validation clearly defined within the broad model governance framework?
- Is the organizational structure of Model Validation clearly defined and documented, taking into account geographical and/or functional coverage?
- To what extent is Model Validation independent of model development?
- Is model approval procedure clearly defined and documented?
- Are there clear escalation lines defined for Model Validation in case of disagreements with the Model Approval Body?
- Does Model Validation possess sufficient capacity to challenge the model developers?
- To what extent are tthe Model Validation's reviews subject to familiarity threads, that is, the risk of overlooking material model deficiencies due to the same people reviewing the model several times for a prolonged period?

Business Focus

- Is Model Validation proactive engaged throughout the model lifecycle?
- Pragmatism rather than technical brilliance – focus on whether the model can be used appropriately and outputs being understood rather than technically having the best statistical performance.
- How and to what extent does Model Validation take into account model, risk and portfolio characteristics of the model?
- Are there clear materiality criteria defined to identifying when and how the validation of a model should take place?
- What kind of other considerations, for example, regulatory, are taken into account when prioritizing the models for validation?
- How and to what extend does Model Validation act as a pragmatic collaborative business and technical advisor to its stakeholders, – i.e. they can suggest modelling options for model developers to consider (without compromising the independence) rather than just a critical reviewer at the end.

Scope of Model Validation

- Which types of models, for example, risk models, economic capital models, valuation models, pricing models, or hedging models, are covered by Model Validation?
- If there are types of models explicitly or implicitly excluded from the scope of Model Validation, is this clearly documented?
- Which validation areas, such as methodology, data quality, or model Use Test, are covered by Model Validation?
- If there are areas explicitly or implicitly excluded from the scope of Model Validation, is this clearly documented?
- How does Model Validation assesses the overall modelling landscape, that is, how do different models interact with each other? Are they compatible etcetera?
- How and to what extent does Model Validation assess the compliance of the model to regulation?

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